

Plantae Chinenses Forrestianae: Coniferae

BY

M. Y. ORR, F.R.S.E.

WITH PLATES CCXL-CCXLII.

The death of Mr. George Forrest, V.M.H., F.L.S., which took place in such tragic circumstances at Tengyueh, north-western Yunnan, on 5th January, 1932, removed from the ranks of famous plant-collectors one who was a master of his craft. An intrepid explorer, as well as a discriminating collector, Mr. Forrest, in the course of seven expeditions to western China extending over a period of 28 years, from 1904 to 1931, broke much new ground, and discovered many rare and interesting forms of plant and animal life, making valuable contributions to our knowledge of the flora and fauna of that part of the world. Horticulture in particular has been enriched enormously as a result of his labours, and the scientific world in general is the poorer for his passing.

During the years he spent in China, Mr. Forrest made Tengyueh his base and Yunnan his principal hunting-ground, but, on occasion, he extended his explorations across the frontier into eastern Tibet, south-western Szechuan, and Upper Burma, each time with fruitful results. Altogether, Mr. Forrest collected upwards of 30,000 specimens of plants, including hundreds of species new to science. Amongst these *Rhododendrons* and *Primulas* rank easily first, and were his favourite genera; but his tastes were catholic, and during his later expeditions he became increasingly interested in the *Coniferae* of the areas he visited. Of these *Coniferae* Mr. Forrest collected many excellent examples belonging to 40 species and varieties, a complete enumeration of which, together with some account of their individual peculiarities, habitats and geographical distribution, is contained in this publication, which forms part of a major work dealing with Mr. Forrest's entire collection of flowering plants and ferns.

Mr. Forrest's conifer material includes a number of species which were new to science at the time of their discovery, as well as some which by their presence here are evidence of important extensions of their geographical range, while, taken as a whole, and in conjunction with his field notes, the collection serves to illustrate the wealth and general distribution of the coniferous flora of this part of western China and Upper Burma. Mr. Forrest's endeavours in this connection

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have been supplemented, although hardly surpassed, by the work of other notable collectors in this field, whose names are mentioned in the context.

In Coniferae Mr. Forrest's most noteworthy find was, undoubtedly, the Silver Fir that bears his name, *Abies Forrestii*, which is one of the most ornamental firs now in cultivation. Other discoveries made by him, which also by their names perpetuate his memory, are *Podocarpus Forrestii* Craib and W. W. Smith, *Tsuga Forrestii* Downie, *Pseudotsuga Forrestii* Craib, and *Abies Georgei* Orr.

To the late Mr. Forrest belongs also the credit of establishing several new records pertaining to the distribution of conifers in western China and Upper Burma, that relating to *Larix Griffithii* J. D. Hooker being, perhaps, the most interesting. This Himalayan species was discovered by Mr. Forrest on the Burma-Yunnan border, south of latitude $26^{\circ} 23' N.$, and its occurrence in this area affords another striking illustration of the composite character of the flora of western China. Other examples of a similar nature are to be found amongst the Junipers, three of the species collected by Mr. Forrest being common to both the Himalayas and the mountains of China, while the Himalayan Yew, *Taxus Wallichiana* Zucc., has been recorded from the provinces of Yunnan and Szechuan by both Mr. Forrest and Dr. Handel-Mazzetti.

Of equal interest, but less capable of a satisfactory explanation, is the presence in Yunnan of certain elements of the Formosan flora which are not known to occur in the intervening provinces of China. Of these probably the best-known is the monotypic genus *Taiwania*, first discovered in north-western Yunnan by Dr. Handel-Mazzetti, and subsequently found by Mr. Forrest in another part of the province. There is also a single record of the occurrence of *Taiwania* in Upper Burma. Only one instance is known of a conifer which is confined entirely to the province of Yunnan, and that is *Abies Forrestii* Craib, the *locus classicus* of which is the Lichiang range, where it was discovered by Mr. Forrest in 1910. It has since been found by Mr. Forrest only in one other locality in Yunnan.

Amongst Mr. Forrest's specimens there are several examples of conifers which are doubtfully native in China, but are extensively planted by the Chinese, and are to be found chiefly in the vicinity of temples, shrines, and human habitations. Some of these "trees that whisper round a temple" are of great antiquity, such as *Ginkgo biloba* Linn., the Maiden Hair tree, which Mr. Forrest states has been cultivated in Yunnan from time immemorial. Other well-known conifers which belong to this category, and are included in this collection, are *Cryptomeria japonica* Don, *Cupressus Duclouxiana* Hickel, and *Thuja orientalis* Linn.; the last-named, it is said, was, once upon a time, a special feature of the gardens of princes and the tombs of emperors.

That Mr. Forrest's conifer collection is a comprehensive one is evident from the nature of its components, the Taxaceae being represented

by 4 genera, comprising 6 species, and the Pinaceae by 13 genera with 30 species. The genera belonging to the Pinaceae are distributed as follows: Abietineae—7 genera with 20 species; Araucarineae—2 genera, each represented by a single species; Taxodineae—1 genus and species; Cupressineae—3 genera with 7 species. The Ginkgoaceae is represented by the single monotypic genus *Ginkgo*. The only conifers not included in this list, and previously recorded from Yunnan, or its borders, by other collectors, are those which have been found in areas not explored by Mr. Forrest. These are *Pseudotsuga sinensis* Dode, *Cupressus funebris* Endl., *Fokienia Kawaii* Hayata, and *Libocedrus macrolepis* Benth. and Hook.

Perhaps the most perplexing problem with which the student of Chinese Coniferae is confronted is the delimitation of the specific boundaries in certain genera, and particularly in *Abies* and *Picea*, both of which are represented in western China by a bewildering series of forms that almost defy co-ordination. The characters which might be utilised to separate these forms are so prone to change, and appear in such varied combinations, that in the absence of sufficient data it is exceedingly difficult to arrive at a proper appreciation of their relative value for taxonomic purposes. Undue stressing of unimportant, or fluctuating features, and their employment as specific criteria, is apt to lead to the creation of a multiplicity of "species," which, despite their non-conformity to type, can be shown to be linked by intermediate forms to a specific centre when a mass of material from a wide area is examined. The subdividing of the Chinese Spruces is a case in point, while amongst the Chinese Silver Firs there are some whose claim to specific rank may require to be reviewed in the light of experience. At the same time it is necessary to guard against a too generous interpretation of specific limits, which may result in the merging of forms that are constitutionally dissimilar. To anyone who has worked with Chinese Coniferae these are very real problems, and in classifying Mr. Forrest's material an endeavour has been made to find a solution that is in strict accordance with true taxonomic principles.

GINKGOACEAE.

GINKGO Linn.

Ginkgo biloba Linnaeus, Mant. ii (1771), 313.

Salisburia adiantifolia Smith in Trans. Linn. Soc. iii (1779), 330.

Yunnan: Lichiang range, No. 10462, July 1913; Chien-Chuan-Mekong divide, No. 23449, July 1923; Shweli-Salwin divide, Nos. 24262, 24808, May–August 1924; hills north-west of Tengyueh, No. 25199, September 1924.

The sole survivor of an ancient race of world-wide distribution, the Maiden Hair tree, to-day, makes its last stand against the ravages of time in rocky fastnesses in the heart of China, although nowhere even in that country, or in Japan where it has been extensively planted, can this tree be said to exist in a truly "wild" state. In Yunnan it has been cultivated from time immemorial, and the tree was never found by Forrest except in the vicinity of temples or human habitations. On the Lichiang range *Ginkgo* flourishes around a lamasery at an altitude of 10,000 ft., which is greatly in excess of the maximum elevation of 1,500 m. recorded by the late E. H. Wilson.*

Forrest's specimens, some of which bear ripe seeds, are in an excellent state of preservation, and were taken from trees of upwards of 90 ft. in height, with a trunk diameter of fully 5 ft. near the base.

TAXACEAE.

CEPHALOTAXUS Sieb. et Zucc.

Cephalotaxus Fortunei Hook. in Bot. Mag. lxxvi (1850), sub t. 4499.

Cephalotaxus filiformis Knight et Perry, ex Gordon, Pinetum (1858), 46.

Cephalotaxus drupacea K. Koch, Dendr. ii, pt. 2 (1873), 104, non Sieb. et Zucc.

Cephalotaxus Griffithii Beiss. in Bull. Soc. Bot. Ital. (1901), 358, non Hook. f.

Cephalotaxus Mannii Masters in Journ. Linn. Soc. xxvi (1902), 545, non Hook. f.

Cephalotaxus drupacea var. *sinensis* auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 89, 187, 221, 271, 287, non Rehd. et Wils.

Yunnan: valley of the Mekong, Nos. 13007, 13404, August–October 1914; eastern flank of Sung-kwei range, No. 13787, May 1917; Tali range, No. 15627, July 1917; eastern flank of the Li-ti-ping, Mekong-Yangtze divide, No. 19475, June 1921; valley of the Mekong, No. 20599, October 1921; hills south of Wei-hsi, No. 21037, November 1921; valleys on the Chien-Chuan-Mekong divide, Nos. 21579, 21953, July 1922; without locality or date, Nos. 29082, 30026, 30856.

Cephalotaxus Fortunei, the "Lo-han-shan" of the Chinese, is one of the widespread species of China. It has been recorded from eight provinces, including Kansu in the extreme north-west, Kwantung in the south, and Chekiang on the shores of the Eastern Sea.

E. H. Wilson described this plant as an inhabitant of the precipitous, limestone regions of western Hupeh and Szechuan. In Yunnan Forrest

* E. H. Wilson in Sargent, *Plantae Wilsonianae*, ii (1914), 1.

collected the greater part of his material east of longitude 90°, in a belt of country 30 miles long, lying between the Mekong and the Yangtze, or its tributaries, and embracing the limestone area of the Lichiang range. In this part of the province *Cephalotaxus Fortunei* was found growing in mixed forests, or in open thickets on the banks of streams, at altitudes varying from 6,000 ft. to 11,000 ft. These particular specimens, many of which bear either flowers or seeds, represent shrubs or small trees ranging from 6 ft. to 40 ft. in height.

Although this species, like the Maiden Hair tree, is associated more commonly with tombs and temples, it was found by Forrest also in the heart of the mountains, far removed from the region of cultivation.

Cephalotaxus drupacea* var. *sinensis Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 3.

Cephalotaxus Fortunei Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 102, non Hooker.

Cephalotaxus Griffithii Beiss. in Bull. Soc. Bot. Ital. (1901), 358, non Hook. f.

Yunnan: eastern flank of the Lichiang range, No. 6743, June 1910; side valleys on the Tali range, No. 11683, June 1913.

Cephalotaxus drupacea Sieb. et Zucc., although recorded from other parts of China, has not been found in Yunnan, and the variety *sinensis*, which is peculiarly Chinese, was discovered by Forrest only in two localities in the province. Regarding the specimen from the Lichiang range E. H. Wilson* wrote: "This is the only material I have seen of this variety from the province of Yunnan." The apparent scarcity of this shrub in Yunnan is remarkable since it is of frequent occurrence, at moderate elevations, in western Hupeh and in Szechuan, more particularly in limestone regions, and extends over the provinces of Hunan and Anhwei, where it descends to 1,000 ft. The Yunnan material was gathered from shrubs of 12-30 ft. in height, growing at altitudes of 9-10,000 ft. The Lichiang specimens bear immature staminate flowers.

TORREYA Arn.

Torreya Fargesii Franchet in Journ. de Bot. xiii (1899), 264.

Torreya grandis Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 7; auct. in Notes Roy. Bot. Gard. Edin., xiv (1924), 96, non Fortune.

Tumion fargesii Skeels in Proc. Biol. Soc. Wash. xxxviii (1925), 88.

Yunnan: Mekong-Salwin divide, No. 19558, June 1921; without locality or date, Nos. 29069, 30024.

The only particulars available regarding Forrest's gatherings of

* E. H. Wilson in Journ. Arnold Arb. vii (1926), 40.

Torreya Fargesii are contained in the field note attached to the herbarium sheet of No. 19558, and therefore this note is quoted *in extenso*: "Shrub or tree of 30-50 ft. In immature fruit. In mixed and pine forest on the Mekong-Salwin divide. Lat. 27° 54' N. Long. 98° 50' E. Alt. 7-8,000 ft. June 1921. N.W. Yunnan."

Forrest's later material from an unknown source is in excellent condition, and all the specimens bear mature seeds. These contain "ruminant" endosperm, a feature which serves, *inter alia*, to separate Franchet's species from Fortune's *Torreya grandis*, a native of the province of Chekiang in eastern China. *Torreya Fargesii* is confined to western China.

TAXUS Linn.

Taxus chinensis Rehder in Journ. Arnold Arb. i (1919), 51.

Taxus baccata Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 103.

Taxus baccata, ssp. *cuspidata* var. *chinensis* Pilg. in Engler, Pflzr., iv, 5 (1903), 112.

Taxus cuspidata var. *chinensis* Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 8.

Yunnan: hills round Tengyueh, No. 7798, May 1912; western flank of Shweli-Salwin divide, No. 9339, November 1912; flanks of Ma-chang-kai valley, No. 9462, December 1912; Shweli-Salwin divide, No. 11789, August 1913; same locality, No. 12087, November 1913; Mekong-Salwin divide, No. 15053, October 1917; without locality, No. 15945, September 1917; Shweli-Salwin divide, No. 24778, August 1924; same locality, No. 25154, September 1924; hills north-west of Tengyueh, No. 25385, November 1924; Shweli-Salwin divide, No. 29597, May 1931.

The specimens of the Chinese Yew enumerated above were collected within a comparatively circumscribed area in north-western Yunnan (between latitudes 25° and 25° 48' N.), and at altitudes ranging from 5,600 ft. in the vicinity of Tengyueh to 11,000 ft. on the Mekong-Salwin divide. They represent shrubs of a few feet in height, growing in open situations among scrub, or in shady thickets on the banks of streams, as well as tall trees of 40-60 ft. in mixed and pine forests. Nos. 11789, 15053, 25154, 25385 are in "fruit," and all the material is very typical of the species. The leaves are more or less sickle-shaped, drying a dull-brown colour, and taper to a horny apex. The dun-coloured twigs terminate in a characteristic bud with ovate scales, each rounded on the back. The seeds are comparatively large, up to 6 mm. in length, and are distinctly two-angled.

A specimen bearing Forrest's number 7798 has been referred to *Cephalotaxus Mannii* by E. H. Wilson,* but presumably in error, since

* E. H. Wilson in Journ. Arnold Arb. vii (1926), 40.

all the material representing this number at present in the Herbarium of the Royal Botanic Garden, Edinburgh, is referable without doubt to *Taxus chinensis* Rehder.

Taxus Wallichiana Zucc. in Abhand. K. Bayr. Akad. Wissensch. iii (1843), 303, t. 3.

Taxus baccata, ssp. *Wallichiana* Pilg. in Engler, Pflzr. iv, 5 (1903), 112.

Taxus cuspidata var. *chinensis* auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 131, 312, non Rehd. et Wils.

N.W. Yunnan: Doker-la, Mekong-Salwin divide, No. 19967, August 1921.

S.W. Szechuan: in side valleys on mountains south-east of Mu-li, No. 22185, August 1922.

Without locality or date, Nos. 29014, 30852.

In the Doker-la and Mu-li stations the Himalayan Yew is a denizen of the mixed forests which clothe the mountain slopes at an altitude of 11,000 ft., and the plants in such situations are described by Forrest as being shrub-like in habit, and 10-40 ft. in height. It is unfortunate that details of the character and distribution of the specimens from which Forrest gathered his later material are lacking, but the localities which provided his earlier numbers both lie north of latitude 28°, and are distant over one hundred miles from one another.

The actual specimens comprising all the gatherings referred to do not differ in any respect from material of *Taxus Wallichiana* collected in Nepal and Bhutan, but they are outwardly, as well as specifically, distinct from specimens of *Taxus chinensis*. The leaves of the former are slightly longer and definitely narrower—they are never more than 2.5 mm. broad—and the apex is more abruptly acute. The scales of the vegetative buds are keeled and pointed, whereas in the Chinese Yew they are ovate and rounded on the back. There is also a marked difference in the colour of the foliage in herbarium specimens of the two species. The leaves of the Chinese Yew, when preserved by drying, are dun-coloured, matching the stem, while those of the Himalayan Yew change to a warm, reddish-brown when dry, contrasting with the pale yellow colour of the twigs. There are other less obvious, although equally characteristic, specific features which also serve to link this material of Forrest's indubitably with the Himalayan species. These are the anatomical features described by Bertrand,* and by Florin,† and their significance in this particular case will be discussed in a subsequent work.

That *Taxus Wallichiana* was to be found in Yunnan was disputed by E. H. Wilson,‡ who believed that this species was confined to the

* C. E. Bertrand in Ann. Sci. Nat. sér. 5, xx (1874), 52.

† R. Florin in K. Sv. Vet. Akad. Handl. ser. 3, x, No. 1 (1931), 227-8.

‡ E. H. Wilson in Journ. Arnold Arb. vii (1926), 41.

north-western Himalayas (although it was known to occur in Burma), and he therefore referred all specimens of yew from the province to *Taxus chinensis*. Wilson's contention was vigorously refuted by Handel-Mazzetti,* who, himself, had collected material of the Himalayan Yew in both Yunnan and Szechuan. Handel-Mazzetti's specimen from Talifu (No. 6408), which the writer has examined, is undoubtedly referable to *Taxus Wallichiana*, and is identical in all essentials with Forrest's more northerly gatherings of this species. In the Herbarium of the Royal Botanic Garden, Edinburgh, there are also specimens of yew collected by Kingdon Ward at Doker-la (No. 1109), and by Cavalerie in Kweichow (No. 7823), both of which should be included in *Taxus Wallichiana*. Kingdon Ward's specimen came from the same area as Forrest's No. 19967, while Cavalerie's material possibly represents, at the present time, the most easterly gathering of this species in China.

That the isolation of *Taxus Wallichiana* in western China is more apparent than real is indicated by a recent report† of the discovery of this yew in the Tsang-po gorge, Tibet, where specimens were collected by Kingdon Ward, and other links with its Himalayan habitat are likely to be discovered in the future.

PODOCARPUS L'Herit.

Podocarpus Forrestii Craib et W. W. Smith in Notes Roy. Bot. Gard. Edin. xii (1920), 219.

Podocarpus macrophyllus Diels in Notes Roy. Bot. Gard. Edin. vii (1912), 258, non D. Don.

Yunnan: eastern flank of the Tali range, No. 4665 (type), August 1906; same locality, No. 6852, August 1910; western flank of the Tali range, No. 15527, August 1917.

Forrest's *Podocarpus*, although somewhat similar to *Podocarpus macrophyllus* D. Don, and originally referred to that species by Diels, is nevertheless specifically distinct from its associated congeners in China. It is most nearly akin to the variety *Maki* Sieb. of *Podocarpus macrophyllus*, from which it differs mainly in the colour, form and texture of its foliage. Its growth-form is that of a shrub, and it reaches a height of 9 ft. in its native habitat on the Tali shan. On the eastern flank of the range it favours shady situations among scrub, whereas on the western slopes it was found growing in open thickets at an altitude of 11,000 ft.

* H. Handel-Mazzetti, *Symbolae Sinicae*, vii (1929), 3.

† C. V. B. Marquand in *Journ. Linn. Soc.* xlviii (1929), 224.

PINACEAE.

PINUS Linn.

Pinus tabulaeformis Carrière, *Traité Conif.* ed. 2 (1867), 510.

Pinus leucosperma Maxim. in *Bull. Acad. Sci. St. Petersburg.* xvi (1881), 558.

Pinus Thunbergii Franchet in *Nouv. Arch. Mus. Paris, sér. 2,* vii (1884), 95, non Parlatore.

Pinus densiflora Franchet in *Journ. de Bot.* xiii (1899), 253, non Sieb. et Zucc.

Pinus densiflora var. *tabuliformis* Masters in *Journ. Linn. Soc.* xxvi (1902), 549.

Pinus Henryi Masters in *Journ. Linn. Soc.* xxvi (1902), 550.

Pinus sinensis Mayr, *Fremdl. Wald. u. Parkb.* (1906), 349, fig. 113, in part.

Pinus Wilsonii Shaw in *Sargent, Pl. Wilson.* i (1911), 3.

Yunnan: Lichiang range, No. 17365, 1918; Chien-Chuan-Mekong divide, No. 23615, May 1923; same locality, No. 23543, July 1923.

Pinus tabulaeformis is said to be the common Hard Pine on the mountains of China, extending westwards at high elevations into Szechuan and Kansu, but descending almost to sea-level in the colder regions of the north and east. In Yunnan Forrest collected this pine on three occasions only, and from only two localities, which points to this species being comparatively scarce in the province. Some years ago E. H. Wilson* referred to the material collected by Schneider in the Yunnanfu district, in 1914, as being the only specimens of this Hard Pine that he had seen from Yunnan, although at the same time he expressed the belief that in all probability it was quite common on the mountains of the more northern parts. Forrest's first locality on the Lichiang range, where *Pinus tabulaeformis* grows gregariously at altitudes of 10-12,000 ft., is fully 200 miles north-west from Yunnanfu, the source of Schneider's specimens, but the extreme limit of the westward trend of this pine in China † is reached only on the Tibetan frontier, where it was discovered in the neighbourhood of Doker-la by Handel-Mazzetti.

This pine was formerly known as *Pinus sinensis* Lambert, but as the latter is considered now to be identical with *Pinus Massoniana* Lambert, which is a native of south-eastern China, the adoption of Carrière's name, *Pinus tabulaeformis*, has been advocated by Rehder.‡

* E. H. Wilson in *Journ. Arnold Arb.* vii (1926), 42.

† A specimen collected by Kingdon Ward (No. 5649) in the Tsang-po valley, Tibet, has been named *Pinus sinensis* Lambert (*Journ. Linn. Soc.* xlviii, 1929, 244).

‡ A. Rehder in *Journ. Arnold Arb.* vii (1926), 22.

This change in the nomenclature, which is based on good grounds, is now widely accepted.

Forrest's Lichiang material alone carries cones, and was taken from a tree of upwards of 60 ft. in height. The cones are sessile, with prominent apophyses, and the densely clustered "needles" are relatively short and stout. In any single leaf the resin-canals occupy both marginal and median positions.

Pinus tabulaeformis* var. *densata Rehder in Journ. Arnold Arb. vii (1926), 23.

Pinus densata Masters in Journ. Linn. Soc. xxxvii (1906), 417.

Pinus prominens Masters in Journ. Linn. Soc. xxxvii (1906), 417.

Pinus sinensis var. *densata* Shaw in Sargent, Pl. Wilson. ii (1914), 17; auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 143.

Yunnan: north-east of Atuntze, No. 20115, September 1921.

This variety of the Hard Pine was found by Forrest on one occasion only, and the inscription on the label accompanying his specimen reads as follows: "Tree of 30-60 ft. In fruit. In conifer forests on the mountains N.E. of Atuntze. Lat. 28° 35' N. Long. 99° 10' E. Alt. 10-11,000 ft. Sept. 1921."

The specimen has the relatively short and stout needles of the species, and the typically oblique cones of the variety.

Pinus yunnanensis Franchet in Journ. de Bot. xiii (1899), 253.

Pinus sinensis var. *yunnanensis* Shaw in Sargent, Pl. Wilson. ii (1914), 17; auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 81.

Yunnan: eastern flank of the Tali shan, No. 19377, May 1921.

Pinus yunnanensis has a more restricted distribution than *Pinus tabulaeformis*, and is confined more or less to the river-valleys of south-western Szechuan and the watersheds of western Yunnan. On the Tali range, where Forrest gathered his material of this pine, *Pinus yunnanensis* is a constituent of the pine forests which cover the eastern slopes at an altitude of 9-11,000 ft. It is here a tree of 60 ft. or more in height, with short branches and long, slender leaves (23-25 cms.), prevailing in fascicles of three. Forrest's specimens bear ripe fawn-coloured cones of considerable size, on which the apophyses are less prominent than in *Pinus tabulaeformis*.

Pinus insularis Endl. Syn. Conif. (1847), 157.

Pinus khasiana Griffith, Notul. Pl. Asiat. iv (1854), 18.

Pinus Kasya Royle ex Parlatore in DC. Prodr. xvi, pt. 2 (1868), 390.

Pinus Khasya Brandis, Indian Trees (1906), 690.

Pinus sinensis auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 144, non Lambert.

Yunnan: Mekong-Salwin divide, No. 20129, September 1921.

The Khasia Pine is primarily a native of Upper Burma, but since climatic conditions on the Mekong-Salwin watershed approximate to those of the Burmese hinterland, it is not surprising that *Pinus insularis* should have crossed the political frontier. J. F. Rock describes it as the most common tree in the extreme south-west of Yunnan, while Handel-Mazzetti* has recorded it from the valley of the Salwin in the northern part of the province.

Forrest found the Khasia Pine on the Mekong-Salwin divide, north of latitude 27°, and in his field notes he describes it as a tree of 30–70 ft. in height, growing in forests at 9–10,000 ft. altitude. The altitude is unusually high for this particular species, which, in Burma, is generally found at moderate elevations. Forrest's specimens have the long, narrow leaves characteristic of the species, and bear dark-brown cones, which are produced either singly or in pairs.

Pinus Armandi Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 95, t. 12.

Pinus quinquefolia David, Journ. Trois. Voy. China, i (1875), 192.

Pinus koraiensis Beiss. in Nouv. Giorn. Bot. Ital. n.s. iv (1897), 184, non Sieb. et Zucc.

Pinus scipioniformis Mast. in Bull. Herb. Boiss. vi (1898), 270.

Pinus Mastersiana Hayata in Gard. Chron. ser. 3, xliii (1908), 194.

Pinus levis Lemée et Lévillé in Fedde, Rep. Spec. Nov. viii (1910), 60.

Pinus excelsa var. *chinensis* Patschke in Bot. Jahrb. xlviii (1912), 657.

Yunnan: hills north of Tengyueh, No. 7758, May 1912; Shweli-Salwin divide, No. 11919, May 1913.

Pinus Armandi is widely distributed in the mountainous regions of western China. It is the only native representative of the 5-needle pines in China, and was named *quinquefolia* by Père David, its discoverer. On the Shweli-Salwin divide, according to Forrest, it is a tree of 90 ft. or less, and is an associate of the coniferous and mixed forests at elevations not exceeding 10,000 ft. The foliage of No. 7758 is infected with a rare fungus, *Phaeocryptopus Abietis* Naoumoff.†

LARIX Mill.

Larix Potaninii Batalin in Act. Hort. Petrop. xiii (1893), 385.

Larix chinensis Beiss. in Mitt. Deutsch. Dendr. Ges. v (1896), 68.

Larix thibetica Franchet in Journ. de Bot. xiii (1899), 262.

Larix Griffithii Masters in Journ. Linn. Soc. xxvi (1902), 558, non Hook. f. et Thoms.

* H. Handel-Mazzetti, Symbolae Sinicae, vii (1929), 16.

† M. Wilson and J. S. L. Waldie in Trans. Brit. Mycol. Soc. xiii (1928), 153.

Pinus sinensis Voss in Putlitz et Meyer, Landlex. iv (1913), 769,
non Lambert.

Yunnan: Lichiang range, No. 6745, August 1910; same locality, No. 10185, June 1913; Hom-pu shan, No. 20210, September 1921; north-east of Atuntze, No. 20285, September 1921; without locality or date, Nos. 30058, 30834, 30850.

S.E. Tibet: Salwin-Kiu Chiang divide, No. 20049, August 1921.

Larix Potaninii, known to the Chinese as "Hung-sha," is the common larch on the mountains of north-western Yunnan, western Szechuan and southern Kansu, extending eastwards along the Tsinlingshan into the south-eastern corner of the province of Shensi. The finding of this Chinese larch on the Salwin-Kiu Chiang divide by Forrest in 1921 was the first authentic intimation of its occurrence across the Tibetan frontier, and it is not improbable that its present range will be extended still further west as a result of further exploration. It seems appropriate at this point to recall that Handel-Mazzetti discovered *Larix Potaninii* on the Burmese frontier in 1916, within 50 miles of Forrest's locale in Tsarong, and for the material (No. 9176) collected by the former on that occasion the varietal name *australis* was proposed by the late Augustine Henry.

Larix Potaninii in its native habitat is a tall, graceful tree with drooping branchlets, forming forests at high elevations, and ascending to 14,000 ft. altitude in the more northern areas visited by Forrest. In such situations the trees were 30-70 ft. in height, but at lower levels on the Lichiang range Forrest reported that this larch attained a height of 120 ft., or more.

Forrest's material from all sources is very typical. The young twigs are of a reddish-brown colour, polished and glabrous except for occasional scattered hairs, while the terminal buds are small and resinous. The leaves on the dwarf branches are comparatively short, not exceeding 2.5 cms. in length, and although they are not conspicuously four-sided in section, as some authorities assert, they possess the distinctive papillate epidermis which is characteristic of the species. The cones on Forrest's specimens are unusually large—those of No. 20285 measuring 5 cms. in length, but in other respects they conform to the recognised type. A coning branch of the material from Hom-pu shan is figured (pl. ccxli, fig. 1).

Larix Griffithii J. D. Hooker, Ill. Himal. Pl. (1855), t. 21.

Abies Griffithiana Lindley et Gordon in Journ. Hort. Soc. v (1850), 214.

Larix Griffithiana Carrière, Traité Conif. (1855), 278.

Pinus Griffithii Parlatore in DC. Prodr. xvi, 2 (1868), 411.

N.E. Upper Burma: western flank of Chimi-li, N'Maikha-Salwin divide, No. 24908, September 1924; same locality, Nos. 26552, 27543, May-October 1925.

W. Yunnan: Shweli-Salwin divide, No. 26769, June 1925; N'Maikha-Salwin divide, east of Hpimaw, No. 27360, October 1925.

Larix Griffithii is reputed to be indigenous to the eastern Himalayas, and in that region it is limited to the more northern parts of eastern Nepal, Sikkim and Bhutan, where it forms pure forests at great altitudes, or consorts with pine on the lower slopes of the mountains. It has long been known to occur also in the Chumbi valley in southern Tibet, but that it should now be recorded from Upper Burma and western Yunnan is remarkable in view of its former restricted geographical range.

Forrest's notable discovery of the Sikkim Larch on the lofty mountains which straddle the Burma-Yunnan boundary was made in 1924, in the course of his sixth expedition to western Yunnan, and all his specimens were collected within a narrow strip of country, not more than 50 miles in extent, lying between latitudes $25^{\circ} 50'$ and $26^{\circ} 33' N$. Such a localised distribution is in keeping with the known habits of this Himalayan larch, although it is difficult to account for its apparent isolation in this far-flung outpost, so remote from its Himalayan base. It is not so difficult to trace the route followed by this species on its march eastwards if Kingdon Ward's theory is correct, and applies to this case. The view* of this distinguished explorer is that "the alpine flora of N.E. Burma . . . has travelled right round in a vast semicircle from the east end of the Himalayas *via* the mountains north of the Irrawaddy sources, and may possibly still be in communication with the supply." That a connecting link with the source of supply actually exists in the case of *Larix Griffithii* is shown by its occurrence in the Tsang-po valley, Tibet, where it was found in quantity by Kingdon Ward in 1924.

In the Burmese locality *Larix Griffithii*, as seen by Forrest, was a comparatively tall tree of 50 ft. or so, growing in the conifer forests on the higher slopes of the watershed above 10,000 ft. altitude, but it did not appear to be a common tree, for in certain situations, e.g. on the Chimi-li, Forrest refers to it as "apparently rare."

Forrest's material was collected at different periods of the year, and represents various stages of growth, all of which, however, bear a specific "hall-mark" which is of use in separating the Sikkim Larch from its congeners in western China. This particular feature is the smooth, not papillate, epidermis of the leaf, accompanied by a continuous hypoderm. Moreover, the leaves are much longer than those of the Chinese Larch, and are keeled only on the under side. The young shoots are usually downy, and the buds have ciliated scales. In Forrest's specimens the dwarf-shoots are remarkably long and stout, especially on older branches, and, indeed, bear a strong resemblance to those of *Pseudolarix amabilis*.

* F. Kingdon Ward in Trans. Bot. Soc. Edin. xxvii (1916), 49.

The majority of Forrest's specimens bear cones, and although none of these is perfectly mature they are relatively large with strongly recurved bracts (pl. ccxli, fig. 2). In the young female flowers the bracts are also long and reflexed.

These specimens of Forrest's are tangible evidence of the intimate relationship known to exist between the flora of the eastern Himalayas and that of the Burma-Yunnan frontier.

PICEA Dietrich.

Picea likiangensis Pritzl in Bot. Jahrb. xxix (1900), 217.

Abies likiangensis Franchet in Journ. de Bot. xiii (1899), 257.

Picea Alcockiana Masters in Journ. Linn. Soc. xxxvii (1906), 418, non Carrière.

Picea Balfouriana Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 30.

Picea likiangensis var. *rubescens* Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 31.

Yunnan: eastern flank of the Lichiang range, Nos. 6746, 6750, August 1910; same locality, Nos. 10151, 10295, June 1913; Chung-tien plateau, No. 13820, June 1917; on Bei-ma shan, No. 13993, June 1917; without locality or date, No. 28636.

S.W. Szechuan: on mountains north-east of Mu-li, No. 21401, June 1922.

Picea likiangensis is the common spruce on the high mountains of north-west Yunnan, but west of the Yangtze, and on the borders of Burma, it is replaced by *Picea brachytyla*. Both species occur also in Szechuan, the Lichiang Spruce being confined more or less to the south-western part of that province, while *Picea brachytyla* extends its range eastwards into western Hupeh. It is worth noting that the variety *purpurea* of *Picea likiangensis* is a relatively common tree in Kansu, and has been recorded also from the Kokonor region of eastern Tibet by J. F. Rock.

In Yunnan the Lichiang Spruce flourishes on the limestone slopes of the range from which it takes its name, forming pure forests at an altitude of 11,000 ft., and in such situations individual trees were estimated by Forrest to be at least 150 ft. in height, with a trunk diameter of fully 10 ft. Further north, on the Chung-tien plateau, *Picea likiangensis* grows to a height of 120 ft., but it is only a medium-sized tree at 12,000 ft. altitude on the mountains north-east of Mu-li, across the Szechuan border. Forrest's material from the last-mentioned locality comprises magnificent cones, measuring 13 cms. in length, and 5 cms. in breadth (pl. ccxlii, fig. 2). Trees grown from seed of Forrest's No. 6746 are now 20 ft. high in the Royal Botanic Garden, Edinburgh.

Picea brachytyla Pritzl in Bot. Jahrb. xxix (1900), 216.

Abies brachytyla Franchet in Journ. de Bot. xiii (1899), 258.

Picea ajanensis Masters in Journ. Linn. Soc. xxvi (1902), 553, non Fischer.

Picea Alcockiana Masters in Journ. Bot. xli (1903), 269, non Carrière.

Picea complanata Masters in Gard. Chr. ser. 3, xxxix (1906), 146, fig. 57.

Picea pachyclada Patschke in Bot. Jahrb. xlvi (1913), 630.

Picea ascendens Patschke in Bot. Jahrb. xlvi (1913), 632.

Picea Sargentiana Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 35.

Picea likiangensis auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 223, non Pritzl.

Yunnan: on the summit of the Li-ti-ping, Mekong-Yangtze divide, No. 19472, June 1921; Mekong-Salwin divide, No. 19788, June 1921; Doker-la, No. 19966, August 1921; Mekong-Salwin divide, Nos. 20030, 20103, August 1921; mountains around Adong, No. 20131, September 1921; hills between Yang-pi and Tai-ping-pu, No. 21070, January 1922; Chien-Chuan-Mekong divide, No. 23232, August 1922; western slopes of the Hpimaw pass, N'Maikha-Salwin divide, No. 24828, August 1924; Mekong-Yangtze divide, north of Pien-tien go, No. 25489, June 1924; without locality or date, Nos. 28724, 28725; Chuiza shan, No. 30854, no date; Chien-Chuan hills, No. 30909, no date.

Picea brachytyla, in so far as it refers to Forrest's material from western Yunnan, is used here in the wide sense prescribed by Dr. Stapf,* and includes therefore the several forms indicated above, which by some authors are regarded as specifically distinct. The writer of these notes, after comparing the material at his disposal, including specimens collected by Wilson and Rock which have been referred to either *Picea complanata* or *Picea ascendens*, considers that such differences as do exist are merely expressive of the natural variableness exhibited by individuals of a widespread species such as *Picea brachytyla*. Forrest's specimens belonging to the *Omorica* section of *Picea* provide an illustration of this inconstancy, but the degree of variation apparent in some of them is scarcely sufficient to justify their assignment to a species other than *Picea brachytyla*.

Forrest refers to this Spruce as the "Mother Mary Tree," and its distinguishing features, as seen by him, are delineated in this portrait appended to the field note on No. 19788: "Tree of 40-90 ft. Branches drooping, not at right angles with the stem, with tips gracefully pendulous. Foliage dark dull green above, bright glaucous white beneath, young foliage soft bright green. Apices almost spinous. Bark rough, flaky, brown-grey." The tree he thus describes was one

* O. Stapf in Bot. Mag. cxlvii (1922), sub t. 8986.

growing in the valley of the Mekong, where, he states, this spruce sometimes attains a height of 120 ft. In a tree of this size the bole, a man's height above the ground, is at least 5 ft. in diameter.

In western Yunnan *Picea brachytyla* covers a wide range of altitude. Forrest found it growing in mixed pine and deciduous woods at 7-9,000 ft. on the Mekong-Salwin divide, and again in similar situations at 11,000 ft. in the Hpimaw pass, while on the summit of the Li-ti-ping this Spruce forms pure forests at 12,000 ft.

Although *Picea brachytyla* is generally distributed throughout Szechuan, and occurs also in western Hupeh, as already indicated, in Yunnan it appears to be confined to the north-western corner of the province, and all Forrest's material of this species was collected west of the Yangtze, and north of latitude 25° N.

These specimens of Forrest's, gathered from a relatively wide area, differ slightly in some respects, e.g. in the amount of pubescence produced on the young twigs, and in the length of the leaves, but these are minor differences which may be correlated with particular habitats. Where cones are present these may have either broad scales, rounded at the distal end—*forma latisquamea* Stapf (Nos. 20103, 20131), or scales with a narrow, crimped apex—*forma rhombisquamea* Stapf (No. 19472), but such distinctions are by no means absolute, and intermediate forms are to be seen in the remainder of Forrest's coning specimens. The ripe cones show little variation in size, and are all approximately 10 cms. in length (pl. ccxlii, fig. 1).

An interesting feature of the anatomy of the leaf of this species was described by the writer * some years ago. The feature referred to is the production of four resin-ducts, in place of the usual two canals, by a process of septation. It is worthy of note that the formation of similar "twin" resin ducts has been observed in leaves of native specimens of spruce referred to *Picea ascendens* and *Picea Sargentiana*, both of which have been relegated by Stapf to *Picea brachytyla*.

TSUGA Carrière.

Tsuga yunnanensis Masters in Journ. Linn. Soc. xxvi (1902), 556.

Abies dumosa var. *chinensis* Franchet in Journ. de Bot. xiii (1899), 258.

Abies yunnanensis Franchet in Journ. de Bot. xiii (1899), 258.

Yunnan: western flank of the Shweli-Salwin divide, No. 9056, August 1912; in side valleys on the eastern flank of the Tali shan, No. 19386, May 1921; Mekong-Salwin divide, Nos. 19709, 19787, July 1921; Mekong-Yangtze divide, No. 19794, July 1921; Doker-la, Mekong-Salwin divide, No. 19968, August 1921; Shweli-Salwin divide, No. 24270, May 1924; same locality, No. 24705, July 1924; Tali

* M. Y. Orr in Notes Roy. Bot. Gard. Edin. xiv (1923), 24.

range, No. 28233, October 1929; Wei Hsi, No. 29043, 1929; without locality or date, Nos. 30025, 30976.

N.E. Upper Burma: western flank of the Chimi-li, N'Maikha-Salwin divide, No. 24907, September 1924; N'Maikha-Salwin divide, No. 29664, June 1931.

Tsuga yunnanensis, known, along with *Tsuga chinensis*, as "Tieh-sha" (Iron Fir), is restricted in its distribution mainly to the mountainous regions of western Yunnan and western Szechuan. Forrest has also recorded it from two localities on the Burmese frontier.

This Hemlock Spruce is described by Forrest as a tree of 30-60 ft. in height, growing in mixed forests, or less frequently in pine woods, at altitudes as low as 7,000 ft., and as high as 10,000 ft. The twigs are markedly pubescent in the grooves, while the leaves are entire at the apex and serrulate on the margin. The cones are sessile, and the scales are few in number and fibrous in texture.

Tsuga dura Downie in Notes Roy. Bot. Gard. Edin. xiv (1923), 16, pl. cxciv, 2.

Yunnan: western flank of the Lichiang range, No. 6747 (type), August 1910.

This species is closely allied to *Tsuga yunnanensis*, from which it differs chiefly in the texture of the cone-scales, these being thick and woody, while the outer surface is smooth and without longitudinal striations. *Tsuga dura* is a tree of upwards of 90 ft. in height, and grows gregariously, or alone, in mixed forests above 9,000 ft. on the Lichiang range.

Tsuga chinensis Pritzel in Bot. Jahrb. xxix (1900), 217.

Abies Tsuga Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 97, non Sieb. et Zucc.

Abies chinensis Franchet in Journ. de Bot. xiii (1899), 259.

Tsuga dumosa var. *chinensis* Pritzel in Bot. Jahrb. xxix (1900), 217.

Tsuga Sieboldi Pritzel in Bot. Jahrb. xxix (1900), 217, non Carrière.

Tsuga yunnanensis Masters in Gard. Chr. ser. 3, xxxix (1906), 236, fig. 93, in part.

Tsuga Brunoniana Masters in Journ. Linn. Soc. xxxvii (1908), 422, non Carrière.

Tsuga formosana Hayata in Gard. Chr. ser 3, xliii (1908), 194.

Yunnan: on the Lichiang range, No. 10293, June 1913; without locality or date, No. 30064.

Tsuga chinensis, which is a common tree on the high mountain ranges of central China, and in the Island of Formosa, appears to be confined to the Lichiang area in Yunnan, where it was found by Forrest associated with other conifers at altitudes of 10-11,000 ft. On the

Lichiang range it grows to a height of 130 ft. with a maximum girth of 20 ft., and provides good timber.

Young shoots of the Chinese Hemlock are yellow in colour, and are universally hairy, while the leaves are generally non-serrulate and have an emarginate apex. The cones on Forrest's specimens are shortly stipitate, and of a dull brown colour.

Tsuga Forrestii Downie in Notes Roy. Bot. Gard. Edin. xiv (1923), 16, pl. cxciv, 7.

Yunnan: Lichiang range, No. 17169 (type), November 1918; Chien-Chuan-Mekong divide, No. 23208, October 1922; mountains north of Yung-pei, No. 23209, October 1922; without locality or date, No. 30701.

S.W. Szechuan: mountains south-east of Mu-li, No. 22173, August 1922.

Tsuga Forrestii is nearly akin to *Tsuga chinensis*, but is readily distinguished from the latter by its tapered cones of a yellowish-brown colour, the individual scales of which are more or less bilobate at the apex, and of a firmer texture than those of *Tsuga chinensis*. In the absence of cones, the reddish-brown colour of the branchlets, and the long, narrow leaves form useful marks of identification. E. H. Wilson* has relegated *Tsuga Forrestii* to *Tsuga chinensis*, but the difference between these two species, as shown by Forrest's coning material, is so marked that the writer has no hesitation in keeping them apart.

Tsuga Forrestii was discovered by Forrest on the Lichiang range, where it was growing in mixed or pure forests between 10,000 ft. and 13,000 ft. He describes it as a tree of 30-80 ft. in height. Subsequent finds have extended its range westwards to the Chien-Chuan-Mekong divide, and eastwards across the Yangtze. Its most northerly station is in the neighbourhood of Mu-li in south-west Szechuan.

PSEUDOTSUGA Carrière.

Pseudotsuga Forrestii Craib in Notes Roy. Bot. Gard. Edin. xi (1919), 189, pl. clx.

Yunnan: Mekong valley, No. 13003 (type), August 1914; same locality, No. 13545, October 1914; Mekong-Salwin divide, No. 19806, July 1921; mountains east of Atuntze, No. 19831, July 1921; without locality or date, No. 30851.

In August 1914, in the course of his third expedition to western Yunnan, Forrest gathered fruiting branches from a tall tree, 60-80 ft. high, which he found growing in mixed forest at 10,000 ft. in the Mekong valley. From the material collected on that occasion Craib described a new Douglas Fir to which he gave the name *Forrestii* in honour of its

* E. H. Wilson in Journ. Arnold Arb. vii (1926), 50, 51.

discoverer. Subsequent expeditions have provided further material of this species—all of which conform to type—but have extended the area which it occupies in the extreme north-western corner of Yunnan by only one degree of latitude. The restriction of *Pseudotsuga Forrestii* to these alpine regions on the confines of Tibet renders it geographically distinct from *Pseudotsuga sinensis* Dode, to which it is closely allied, and from *Pseudotsuga Wilsoniana* Hayata, a native of Formosa, with which E. H. Wilson * considered it to be synonymous. The writer has seen no specimens of the Formosan species, but Hayata's comprehensive description,† together with the excellent figures that accompany it, suffice to show that *Pseudotsuga Wilsoniana* and *Pseudotsuga Forrestii* are not identical, and a brief enumeration of the salient points of difference will make this clear.

The cones of *Pseudotsuga Wilsoniana* are sessile, while those of *Pseudotsuga Forrestii* are distinctly pedunculate (pl. ccxlii, fig. 3). In the former, the basal-winged portion of the bract-scale is unduly prolonged, and overtops the cone-scale, the cusp being reduced to a mere point about 2 mm. long. In the latter, the corresponding part of the bract-scale never exceeds the cone-scale—it is usually only half its length—while the cusp is here drawn out to a length of 1.2 cms. In the vegetative organs the chief differentiating feature is the comparative length of the leaves, those of *Pseudotsuga Wilsoniana* being only 1.8 cms. long, while in *Pseudotsuga Forrestii* the needles measure up to 4.5 cms. in length, and are broader in comparison. In the buds of the former the scales are distinctly ciliate, but in the latter species the buds are resinous, and the scales are not conspicuously ciliate. Such dissimilarity, accentuated by minor differences, seems to afford sufficient grounds for the retention of *Pseudotsuga Forrestii* as a specific entity.

KETELEERIA Carrière.

Keteleeria Davidiana Beissner, Handb. Nadelholz. (1891), 424, fig. 117.

Pseudotsuga Davidiana Bertrand, ex Carrière in Rev. Hort. (1873), 37, figs. 3-5.

Abies sacra David, ex Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 100, t. 14.

Abies Davidiana Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 98, t. 13.

Keteleeria sacra Beissner, Handb. Nadelholz. (1891), 426.

Podocarpus sulchuenensis Franchet in Journ. de Bot. xiii (1899), 265.

Pinus sacra Voss in Mitt. Deutsch. Dendr. Ges. xvi (1907), 94.

* E. H. Wilson in Journ. Arnold Arb. vii (1926), 51.

† B. Hayata, Icon. Pl. Formos. v (1915), 204, t. 15.

Keteleeria formosana Hayata in Gard. Chr. ser. 3, xliii (1908), 194.

Keteleeria Esquirolii Léveillé in Fedde, Rep. Spec. Nov. viii (1910), 60.

Yunnan: south-east base of the Sungkwei pass, No. 7386, November 1910; north end of Hocking valley, No. 10230, May 1913; Tong shan, in the Yangtze bend, No. 11114, September 1913; Chungtien plateau, No. 11425, September 1913; mountains north-east of Yangtze bend, No. 11436, October 1913; Shunpi-Yangpi divide, No. 13727, April 1917; ranges west of Tali, No. 17788, December 1918; N'Maikha-Salwin divide, No. 18373, August 1919; hills round Yung-peh, No. 21042, December 1921; hills south-west of Lichiang, No. 21428, June 1922; Tali range, No. 28228, no date; without locality or date, Nos. 30907, 30961.

S.W. Szechuan: in side valleys south-east of Mu-li, No. 22180, August 1922.

Keteleeria Davidiana is generally distributed through the central and south-western provinces of China, and occurs also in Formosa. In Yunnan Forrest found it in diverse localities, from the borders of Szechuan in the north to the Burmese frontier in the south-west, and at altitudes varying from 7,000 ft. to 11,000 ft. At moderate elevations this *Keteleeria* tends to become a tall tree—on the low hills north of the Hocking valley it grew to a height of 140 ft.—but the average height of the trees which furnished the bulk of Forrest's material was round about 60 ft. It was generally found associated with other conifers, and in none of the localities given by Forrest did it ever form woods as in Szechuan.

Forrest's *Keteleeria* material exhibits a lack of uniformity in the vegetative parts, and also in the cones, which is quite in keeping with the well-known tendencies of this polymorphous species. The number of synonyms quoted above testify to the inconstancy of its characters and to the particular significance attached to the variants by other authors. The inclusion of so many forms in *Keteleeria Davidiana* is perhaps open to criticism, and the institution of varieties might be conceded, but, after analysing *Keteleeria* material collected by Maire, Henry, Wilson and others, it becomes evident that the differentiating features are by no means correlated, although the degree of variation may be very pronounced in one or other particular. This is borne out by Forrest's specimens, the details of which are given below.

The branchlets are grey in most, but reddish-brown or yellowish in some, and either perfectly glabrous, or coated with a red or black pubescence of variable density. The leaves are from 3 mm. to 5.5 mm. in length, and, for the most part, they have stomata on both surfaces—on the under surface from 12–16 lines of stomata on each side of the midrib, and from 2–6 lines in the corresponding positions on the upper side. The apex of the leaf is usually acute, though sometimes apiculate. Internally the characteristic undivided vascular bundle is

a constant feature, together with the "colourless cells" mentioned by Masters,* although the value of the latter for diagnostic purposes is problematical.

The majority of Forrest's specimens bear magnificent cones, and these vary in size, in colour, and in the shape of the scales. The average length of these cones is 15 cms., but in No. 28228 from the Tali range the cone is 22 cms. long, and is abnormally narrow. As regards the colour of the cones, various shades of brown are apparent with sometimes a tinge of yellow. The scales of the cones on specimens from the Lichiang range (pl. ccxli, fig. 3) are coated with a white bloom, which produces a striking effect. These particular cones are only 12 cms. long. In almost all the cones the margin of the scales is fimbriated, while the distal end is either rounded or retuse, erect or recurved. Amid all this diversity of form and feature, however, there is nothing sufficiently outstanding to preclude the inclusion of every one of Forrest's numbers in *Keteleeria Davidiana*.

ABIES Linn.

The genus *Abies* is represented in western China by a perplexing series of forms, some of which are separated by characters so few and fluctuating that they almost defy co-ordination. At least five of these forms are common to the province of Yunnan, namely *Abies chensiensis* Van Tieghem (*Abies Beissneriana* sensu Wilson), *Abies Faberi* Craib, *Abies Forrestii* Craib, and *Abies Faxioniana* Rehd. et Wils. To this list there must now be added the less common and but recently described species, *Abies Georgei* Orr. Of the foregoing *Abies chensiensis* is a distinct and well-defined species; nevertheless Wilson † has referred all specimens of it from Yunnan to *Abies Beissneriana* Rehd. et Wils., a species based upon certain minor deviations from Van Tieghem's imperfectly described type. The status of *Abies Delavayi* is likewise beyond cavil, but among the remainder there are some whose claim to specific rank is not so well-founded, and there is much to be said in favour of the new combinations recently proposed by A. B. Jackson,‡ despite the doubtful merging of *Abies Faberi* in *Abies Delavayi* var. *typica*. Whatever may be said of cultivated plants, native specimens of *Abies Faberi* and *Abies Delavayi* (particularly those from the Tali range) are distinct enough, and there can be little doubt of the separate identity of these two firs. Moreover, as pointed out by Craib,§ Wilson's Szechuan plant of *Abies Delavayi* (*Abies Faberi* sensu Craib), which is the common "*Abies Delavayi*" of cultivation, is certainly not identical

* M. T. Masters in Gard. Chr. 3rd ser. i (1887), 481; xxxiii (1903), 84.

† E. H. Wilson in Journ. Arnold Arb. vii (1926), 54.

‡ A. B. Jackson in New Flora and Silva, iii (1931), 252; in "Conifers in Cultivation" (Report of the Conifer Conference, 1931), 243. London, 1932.

§ W. G. Craib in Notes Roy. Bot. Gard. Edin. xi (1919), 277.

with Franchet's species of that name. On the other hand, *Abies Faberi*, *Abies Forrestii*, *Abies Georgei* and *Abies Faxoniana* have every appearance of being closely akin, and these might quite well be deemed varieties or forms of one and the same species, but not of Franchet's *Delavayi*. Such a view of the inter-relationship of these species is amply borne out by the native material collected by Forrest, as well as by the striking similarity of plants of *Abies Faberi* and *Abies Forrestii* in cultivation, but it is vitiated to some extent by the character of cultivated specimens of *Abies Faxoniana* introduced by E. H. Wilson. In the latter the vegetative parts (the writer has seen no cones from cultivated plants) not only present many obvious points of difference when contrasted with cultivated specimens of *Abies Forrestii* and *Abies Faberi*, but are wholly at variance with the description of the species as set forth in *Plantae Wilsonianae*. This non-conformity to type—a feature not uncommon among Chinese conifers—adds materially to the difficulty of establishing the identity of the plants concerned, and tends to complicate the problem of determining their relationship.

It is axiomatic that any change in the taxonomy of Chinese *Abies* must be based on the characteristics of both cultivated and native specimens, and in view of the discrepancies referred to above, or until such time as these receive a satisfactory explanation, it seems undesirable to alter the present system of nomenclature. In describing Forrest's material it has been decided therefore, for this and other reasons, to retain the specific designations by which these plants are generally known.

Abies chensiensis Van Tieghem in Bull. Soc. Bot. France, xxxviii (1891), 413.

Abies sp. Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 100; L. Beissner, Handb. der Nadelholzk. (1891), 426.

Abies firma Masters in Journ. Linn. Soc. xxvi (1902), 557, non Sieb. et Zucc.

Abies Beissneriana Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 46.

Yunnan: Lichiang range, No. 10281, June 1913; Mekong-Salwin divide, No. 19796, July 1921; Chien-Chuan-Mekong divide, Nos. 22272, 23202, September-October 1922; eastern flank of the Lichiang range, No. 22280, September 1922; mountains north-east of the Lichiang range, No. 30663, without date.

Abies chensiensis with its yellow-grey branchlets and grey-brown cones is quite unique among the silver firs of Yunnan. It was discovered originally in the Tsinling mountains in Shensi province by Abbé David in 1872, and was first described under this name by Van Tieghem, but without much particularisation. This meagre account of the type material was amplified by the subsequent publication in *Plantae Wilsonianae* of a detailed description based on specimens

collected by Wilson in western Hupeh in 1907. At the same time very similar material brought from western Szechuan was made the type of a new species to which Rehder and Wilson* gave the name of *Abies Beissneriana*, and all material of a like nature from Yunnan seen by Wilson, including Forrest's No. 10281, has been referred by him to this new species.

According to the authors the chief points of difference between the two species are these: in *Abies Beissneriana* the foliage is assurgent, in *Abies chensiensis* horizontally spreading, the leaves of the former are shorter and narrower than those of the latter, with stomata on both surfaces, rarely channelled above, the apex of the leaf being acute rather than emarginate; the cones of *Abies Beissneriana* are said to be pedunculate—not sub-sessile as in *Abies chensiensis*, less symmetrical and somewhat smaller, but as regards the scales and seeds there is apparently no valid distinction between the species.

The writer has seen only a fragment of Van Tieghem's type, but, after comparing Wilson's gatherings of both species with specimens collected in the provinces of Yunnan and Szechuan by Forrest, Handel-Mazzetti, Schneider and Rock, he is unable to agree that the differentiating characters quoted above have any specific value whatsoever. In Forrest's material particularly these features do not appear to be correlated in any way, but are promiscuously distributed throughout. Forrest's No. 10281, named *Abies Beissneriana* by Wilson,† has pubescent twigs with horizontally spreading leaves, which are channelled above, and emarginate at the apex. On the fruiting branches of F. 23202 the individual leaves are similar to those of F. 10281 as regards length and form, but stomata are present on both surfaces and the foliage tends to become assurgent. In F. 30663 the leaves are uniformly short and distinctly assurgent, but still show an impressed adaxial surface together with a retuse apex, while the cones are both pedunculate and sessile on the same branch. Forrest's specimen from the Mekong-Salwin divide, which comprises sterile branches with leaves up to 6 cms. long, ending in two sharp points, is in no way different to young plants of *Abies chensiensis* in cultivation, and is identical with Rock's No. 11518 from the Salwin-Irrawaddy watershed, referred to *Abies Beissneriana* by Wilson, with the remark that the specimen was evidently from a young plant. This, despite the fact that in general appearance and particulars the specimen in question is a direct negation of the published description of this species.

Apart from a certain variableness, not unconnected with the transition from sterile to fertile branches, there would appear to be no constant criteria by which *Abies Beissneriana* may be distinguished from *Abies chensiensis*, and in the writer's opinion the former ought to be

* Rehder and Wilson in Sargent, *Plantae Wilsonianae*, ii (1914), 47.

† E. H. Wilson in *Journ. Arnold Arb.* vii (1926), 55.

regarded as synonymous with the latter, to which species all Forrest's specimens have been assigned.

According to Forrest *Abies chensiensis* grew to a height of 130 ft. on the Lichiang range, but was not so tall a tree in the other localities. It was found by him in mixed or conifer forests, generally at an altitude of 11,000 ft., but descending to 8,000 ft. on the Mekong-Salwin divide. Forrest's last consignment of material included ripe cones, and these are fully 10 cms. long and 5 cms. broad. Plants of *Abies chensiensis*, grown from seed collected by Forrest, have been in cultivation for some years.

Abies Delavayi Franchet in Journ. de Bot. xiii (1899), 255.

Yunnan: eastern flank of the Tali range, No. 4606, April-May 1906; western flank of the Shweli-Salwin divide, No. 9340, November 1912; same locality, No. 11898, June 1913; same locality, No. 18047, May 1919; N'Maikha-Salwin divide, No. 18855, November 1919; eastern flank of the Tali range, Nos. 19378, 20813, May 1921; Shweli-Salwin divide, Nos. 25277, 25295, 25298, October 1924; same locality, No. 25378, November 1924; hills north-west of Tengyueh, No. 26095, December 1924; Shweli-Salwin divide, No. 26779, June 1925; Tali range, No. 28229, 30975, without date.

N.E. Upper Burma: western flank of the Chimi-li, N'Maikha-Salwin divide, No. 24777, August 1924.

The *locus classicus* of Franchet's species is the Tali range, where it was found originally by Delavay. Here, according to Forrest's account, *Abies Delavayi*, intermixed with *Piceas* and *Tsugas*, forms extensive forests, extending the whole length of the range, at altitudes ranging from 7,000 ft. to 14,000 ft. From further gatherings made by Forrest and other collectors in the extreme west of the province, *Abies Delavayi* is known to occur also along the Burma-Yunnan border, from Tengyueh northwards as far as Chimi-li. In both of these areas, despite climatic changes, this fir maintains its characteristic habit, and specimens taken from trees growing at a high elevation on the eastern slopes of the Tali range are in no way different from those collected by Forrest, or Rock, on the Shweli-Salwin watershed.

Undoubtedly the most distinctive feature of *Abies Delavayi* is the foliage, consisting of relatively short and rigid leaves, which, at least in herbarium material, have strongly revolute margins. On Forrest's specimens, taken from trees of 90 ft. in height, the leaves, which are 1-1.8 cms. long, are borne in dense, fan-shaped clusters, and for the most part have the margins so completely inrolled that the under surface of the leaf, including the midrib, is wholly concealed from view. This peculiarity, which is stressed by Franchet in his description of the species, is a consistent one, and is not met with in any other Chinese silver fir except *Abies Faberi*. In the latter species, however, the recurving of the leaf-margin, as shown by dried material, is neither so

universal nor so pronounced as in *Abies Delavayi*, while the leaves are commonly twice as long, and of a different texture. Notwithstanding other differentiating features, the mere fact that the tightly rolled leaves of *Abies Delavayi* have a counterpart of sorts in *Abies Faberi* is a prime factor in most cases of mistaken identity, and has been the cause of endless confusion. It has led to the suggestion, put forward by some authors, that these two types of silver fir are but geographical forms of one and the same species. Such a belief is largely discounted by the fact that typical material of *Abies Faberi*, indistinguishable from that collected on the Burmese frontier, was brought by Forrest from the Delavayan locality on the Tali range, where this species is associated with the true *Abies Delavayi*, and is subject to the same climatic and edaphic conditions.

Forrest's very adequate specimens of *Abies Delavayi* have rugose stems, which are of a characteristic dusky hue, faintly tinged with red in parts, but never becoming a warm reddish-brown as in *Abies Faberi*. The amount of pubescence is variable, and the youngest shoots are sometimes perfectly glabrous, which is the more common state in Craib's species. The general features of the foliage have been outlined above, but mention must be made of the prevailing tendency of the individual leaves to curve inwards from a point about half-way between base and apex. This incurving of the leaf is referred to by Franchet in his original description of *Abies Delavayi*, and is clearly seen in Forrest's specimens. The vegetative buds, which are more or less hidden by the bunching of the uppermost leaves, are comparatively small, ellipsoidal in shape, and are thickly incrustated with resin. The cones accompanying Forrest's material average 10 cms. in length, and are about 4.5 cms. broad at the thickest part, which is near the base. At maturity, the cone, which is sub-sessile, is bluish-black in colour, with, here and there, a clot of resin on its surface, and at this stage only the tips of the shortly-cuspidate bracts remain visible between the cone-scales. Male strobili are present on specimens from the Tali range, but these possess no outstanding features; they are mainly about 2 cms. long, and are shortly stipitate. All Forrest's specimens of *Abies Delavayi* from the province of Yunnan were collected south of lat. 26° 23' N., and west of long. 100° 12' E.

The terminal portion of a branch from Forrest's No. 20813, showing the characteristic arrangement of the foliage on the Tali specimens, is figured on plate ccxl, fig. 2.

Abies Faberi Craib in Notes Roy. Bot. Gard. Edin. xi (1919), 278 ;

Stapf in Bot. Mag. cliii (1927), sub t. 9201.

Keteleeria Fabri Masters in Journ. Linn. Soc. xxvi (1902), 555.

Abies Delavayi Masters in Journ. Linn. Soc. xxxvii (1906), 422 ;

Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 41, non

Franchet.

Pinus Fabri Voss in Putlitz et Mayer, Landlexikon, iv (1913), 773.

Yunnan: western flank of the Shweli-Salwin divide, No. 9076, August 1912; eastern flank of the Tali range, No. 19388, May 1921; same locality, No. 23206, October 1922; Shweli-Salwin divide, No. 24365, June 1924; same locality, north of Ho-tou, No. 26305, March 1925; Shweli-Salwin divide, No. 26358, May 1925; same locality, No. 26747, June 1925; north of Ho-tou, No. 27348, October 1925.

N.E. Upper Burma: western slopes of the Chimi-li, N'Maikha-Salwin divide, No. 24899, September 1924; west of Tzi-Tzo-ti, No. 26549, April 1925, No. 27551, November 1925; western flank of the N'Maikha-Salwin divide, No. 26559, May 1925; without locality or date, No. 27567.

Non-conformity to type of certain silver firs from western Szechuan, lately introduced into cultivation as *Abies Delavayi* Franchet, led Craib, after a critical analysis of all material then available, to propose the new combination *Abies Fabri*, taking Faber's specimen from Mount Omei, which had been misnamed *Keteleeria Fabri* by Masters, as the type of the new species, and combining with it the Wilsonian material from Wa-shan, referred to above. The grounds for the separation of this Szechuan material from that collected by Delavay in Yunnan are given in substance in the note on *Abies Delavayi* (p. 142), and the points of difference stressed by Craib in his paper are, if anything, accentuated by the distinctive appearance of Forrest's later material of *Abies Fabri* from the Shweli-Salwin divide. In some respects, indeed, these particular specimens of *Abies Fabri* approach more nearly *Abies Webbiana* of the eastern Himalayas, a species now known to occur as far east as the Tsang-po gorge in Tibet.

The young branches of Forrest's specimens of *Abies Fabri* are mainly glabrous, and are coloured a warm reddish-brown. The older branches are ribbed. The leaves, which vary in length from 2.5 cms. to 3.5 cms., are arranged in a pectinate manner, and may be assurgent. They are, for the most part, distinctly curved, but, except on the ultimate branchlets, they are not directed forwards as in *Abies Delavayi*. The apex of the leaf tends to become more conspicuously emarginate than in the latter species, but the recurving of the leaf-margins is less complete, and the white, stomatal bands are only partially obscured. This tendency of the leaves of *Abies Fabri* to become revolute, however noticeable it may be in native specimens, is, nevertheless, not a characteristic of the living foliage of young plants in cultivation, and it is a moot point whether this trait has any specific value in this particular species. The fact remains that, apart from *Abies Delavayi*, in which this feature is so pronounced that it is reflected in the leaf-anatomy, native specimens of no other Chinese silver fir exhibit a similar tendency in the foliage although preserved in precisely the same way.

The vegetative buds on Forrest's specimens of *Abies Fabri* are

chestnut-coloured, lustrous, and are less obviously resinous than those of *Abies Delavayi*. Male strobili are prominent structures on virile young shoots, the exposed parts of the strobile being of a bluish-black colour, while the shortly-stalked, cylindrical cones, which are of a like dark hue when immature, but tend to become brownish as they ripen, are borne on the older branches. The ripe cones are more or less resinous, as in *Abies Delavayi*, but they are relatively smaller than in that species, and the bract-scales are, perhaps, not so evident outwardly at maturity.

With the possible exception of No. 19388, all Forrest's material of *Abies Faberi* was obtained on the Burma-Yunnan border (between lats. 25° 20' and 26° 23' N.), where this species grows to a height of 80 ft. with a trunk diameter, a man's height from the ground, of upwards of 4½ ft. It was found usually associated with other conifers or in mixed forests, and only rarely did it occur in isolated clumps or as single specimens.

Abies Faberi has been in cultivation now for a number of years, and in certain of the plants introduced by Wilson from western Szechuan a resemblance to *Abies Forrestii* is very marked, except that the foliage of the former is not conspicuously assurgent.

A young shoot of Forrest's No. 26559 from the N'Maikha-Salwin divide is figured on plate ccxl, fig. 1.

Abies Forrestii Craib in Notes Roy. Bot. Gard. Edin. xi (1919), 279, pl. 162; Stapf in Bot. Mag. cliii (1927), sub t. 9201.

Abies Delavayi auct. in Notes Roy. Bot. Gard. Edin. vii (1913), 334, non Franchet.

Yunnan: eastern flank of Lichiang range, No. 6744 (type), August 1910; western flank of Lichiang range, No. 10152, June 1913; Chien-Chuan-Mekong divide, No. 22350, September 1922; same locality, No. 23204, October 1922; same locality, No. 23544, July 1923; same locality, No. 23617, May-June 1923.

Abies Forrestii, of which living examples are to be seen in many conifer collections, was introduced into cultivation originally under the name of *Abies Delavayi*. The unique appearance presented by the young plants—it is one of the most striking of the cultivated Chinese silver firs—made identification with Franchet's species seem improbable, and, after full investigation, Craib reached the conclusion that these plants represented a new species, which he named *Abies Forrestii*, taking as the type Forrest's No. 6744 from the Lichiang range.

Abies Forrestii is distributed generally along both sides of the Lichiang range at altitudes of 10-12,000 ft., forming pure forest on the eastern slopes, but occurring intermixed with pine and larch on the western flank, where individual trees of 130 ft. in height were noted. Forrest's later numbers were collected on the Chien-Chuan-Mekong divide, some 70 miles to the south-west of the type locality.

Native material of *Abies Forrestii* is characterised by its wrinkled, reddish-coloured branchlets, glabrous for the most part, or with a few scattered, erect hairs, its pectinate foliage tending to become assurgent, and its large buds completely immersed in resin. The leaves vary in length from 1.5 cms. to 3 cms. (mainly 2 cms.), and are relatively broad, the apex of the leaf being emarginate in most, but becoming apiculate in leaves on leading branches, while the leaf-margins are scarcely, if at all, recurved.

The sub-sessile, cylindrical cones of *Abies Forrestii* * are not unlike those of *Abies Faberi* in their general appearance, although they are not so large—they rarely exceed 9 cms. in length—and not so resinous, while the bract-scales, which are more or less exerted at maturity, are of a different shape. The colour of the cone, as in *Abies Faberi*, tends to change from bluish-black to brown as it ripens, while the tan-coloured seeds, which are 8 cms. long, are furnished with a broad wing, equalling the seed in length and of a greenish-yellow hue mottled with black.

Cultivated plants of *Abies Forrestii* are chiefly distinguished by their upturned foliage, exposing the very white under surface of the leaves, and by their massive buds encased in a white resin.

Abies Georgei Orr in Notes Roy. Bot. Gard. Edin. xvii (1933), 1, pl. ccxxxvi.

Yunnan: Chien-Chuan-Mekong divide, No. 22547 (type), September 1922; same locality, No. 23203, October 1922; western slopes of the Sungkwei range, No. 23205, October 1922; Chuiza shan, Wei Hsi district, No. 30853, without date.

Probably also referable to this species, but without assurance in the absence of cones, are the following numbers: Lichiang range, Nos. 10206, 10225, June 1913; same locality, No. 10294, July 1913.

The principal localities which furnished authentic material of this recently described species lie in the mountainous region to the south and east of the Yangtze bend. Here, *Abies Georgei* is a tree of 40–70 ft. in height, growing in conifer forests at high elevations, being seldom found below 10,000 ft. It bears a close resemblance to *Abies Forrestii* in its habit and in most of its vegetative characters, but differs markedly from this species in the distinctive features of its cone. The latter is peculiar in having very prominent bract-scales of an unusual shape, which, even in the ripe cone, cover the greater part of the subjacent cone-scales. These bract-scales are of a glaucous blue colour, with a brown, erose margin, and are terminated by cusps of upwards of 1 cm. in length, which are either erect or recurved. The winged seeds, however, are very similar in both form and colour to those of *Abies Forrestii*.

In its vegetative parts the resemblance to *Abies Forrestii* becomes more marked. The foliage is of the same pectinate type in both species,

* "Conifers in Cultivation" (Report of the Conifer Conference, 1931), pl. 76. London, 1932.

the leaves are essentially similar in shape, and the broadly ovate buds of *Abies Forrestii*, incrustated with resin, have an exact counterpart in those of *Abies Georgei*. Only the branches are different: whereas those of *Abies Forrestii* are typically glabrous, the young shoots of *Abies Georgei* are thickly coated with a ferruginous indumentum, and in this respect the latter species approaches *Abies Faxoniana*. Notwithstanding this, there is little doubt that *Abies Georgei* is closely related to *Abies Forrestii*, although separated from it by the characters of the cone, and by its densely pubescent shoots.

The systematic position of *Abies Georgei*, with special reference to its congeners in western China, is discussed at length in the paper containing the original description of this species.

Abies Faxoniana Rehder et Wilson in Sargent, Pl. Wilson. ii (1914), 42.

S.W. Szechuan: mountains east of Yung-ning, No. 21952, July 1922; same locality, No. 28679, without date.

Yunnan: mountains north-east of Atuntze, No. 20110, September 1921; Doker-la, Mekong-Salwin divide, No. 20117, September 1921; mountains due north of Atuntze, near Adong, No. 20126, September 1921; Mekong-Yangtze divide, No. 20132, September 1921; Mekong-Salwin divide, No. 20940, September 1921; Chien-Chuan-Mekong divide, No. 22996, October 1922; without locality or date, No. 30423.

N.E. Upper Burma: western flank of the Chimi-li, N'Maikha-Salwin divide, No. 24746, June 1924; same locality, No. 26002, October 1924; near Du-da-la, north of the Chimi-li, Nos. 26810, 27511, June 1925; western flank of the N'Maikha-Salwin divide, Nos. 27031, 27531, July-October 1925; same locality, No. 29796, June 1931.

Abies Faxoniana is apparently a widely distributed species in western China. Discovered originally by Wilson in south-western Szechuan in 1910, it was found later by Forrest in north-western Yunnan, and, more recently, by Rock in south-eastern and central Kansu. It has been recorded also from Upper Burma. It is possible, however, that this species may embrace more than one form, for some of Forrest's specimens, particularly those from the Burmese frontier, while they embody the essential characteristics of the species as defined by Rehder and Wilson, nevertheless seem to be singularly robust in comparison with the co-types from Szechuan, besides exhibiting certain minor differences, which may be correlated with particular climatic conditions, but might be considered to be of such importance as to justify varietal distinction.

Forrest's material of *Abies Faxoniana*, which includes some of the finest specimens in his conifer collection, was cut from trees of various sizes up to 90 ft. in height. Of No. 27031 Forrest wrote, "a good timber tree, straight in growth, with a girth of 6-7 ft. at 5 ft. from the base," which is surprising in view of Wilson's report that the wood of

this species (in Szechuan) is soft and of little value. In the northern parts of Yunnan *Abies Faxoniana* grows commonly at altitudes of 13-14,000 ft., but in the monsoon region of Upper Burma it occurs most frequently at lower elevations, generally below 11,000 ft. In both of these areas, as in Szechuan, it forms considerable forests, although it has been found, not infrequently, associated with other conifers and deciduous trees.

All the specimens enumerated above have extremely villose shoots, and comparatively small, very resinous, ovoid buds of a dark red colour. The leaves, which are 1-2 cms. long, are spirally arranged, but spread in one plane, and tend to point forward, those near the apex of the branchlets concealing the bud. They are constricted at the base, and have a rounded or emarginate apex, but the under surface of the leaf is not so white as it is in either *Abies Forrestii* or *Abies Faberi*, nor are the leaf margins perceptibly recurved. The leaf differs also, anatomically, in having median in place of marginal resin canals, and these are very often conspicuously wide. The outline of the leaf-section, too, is very characteristic.

The ripe cones on Forrest's specimens are of medium size, and are not unlike those of *Abies Forrestii* in shape and colour, with shortly exerted, cuspidate bract-scales. They are perfectly sessile, however, and are more or less resinous. The winged seeds have a dark brown colour, and are often tinged with purple.

That *Abies Faxoniana* is nearly akin to both *Abies Forrestii* and *Abies Faberi* is shown by Forrest's specimens, and all three might well be regarded as varieties of one species, since their particular differentiating features have a doubtful specific value. There still remains, however, the problem of "placing" the Wilsonian plants of *Abies Faxoniana* in cultivation, a problem which may prove to be incapable of solution until such time as these reach adult proportions. In their present state some, at least, of the plants in question neither display the characteristic features of the native material, nor do they conform to the details of the published description of this species.

The specimens represented by the following numbers are indeterminate through lack of decisive evidence.

20809. *Abies* sp. Tree of 30-70 ft. In conifer forests on the Bei-ma shan. Lat. 28° 18' N. Long. 99° 10' E. Alt. 13-14,000 ft. September 1921. N.W. Yunnan.
21016. *Abies* sp. Tree of 30-60 ft. Forming forests on the mountains east of Atuntze. Lat. 28° 35' N. Long. 99° 12' E. Alt. 11,000 ft. November 1921. N.W. Yunnan.
23207. *Abies* sp. Tree of 50-60 ft. Conifer forests on the mountains north of Yung-peh. Lat. 26° 55' N. Long. 100° 50' E. Alt. 11,000 ft. October 1922. N.W. Yunnan.

CUNNINGHAMIA R. Brown.

Cunninghamia lanceolata Hooker in Bot. Mag. liv (1827), sub t. 2743.

Pinus lanceolata Lambert, Descr. Pinus (1803), 52, t. 34.

Abies lanceolata Poirlet in Lamarck, Encycl. Méth. vi (1804), 523.

Belis jaculifolia Salisbury in Trans. Linn. Soc. viii (1807), 315.

Cunninghamia sinensis R. Brown ex Richard, Conif. (1826), 80, t. 18, fig. 3.

Belis lanceolata Sweet, Hort. Brit. (1830), 475.

Raxopitys Cunninghamii Nelson, Pinaceae (1866), 97.

Yunnan: Tali range, No. 28232, July 1929.

Forrest gives no particulars regarding this, the only specimen of its kind collected by him, but, according to Wilson,* *Cunninghamia* is a handsome tree with a mast-like trunk and spreading branches. It is known, in the vernacular, as *Sha-shu*, and is to be found all over the temperate regions of China. It provides useful timber, which, on account of its fragrant properties, is said to form the principal coffin-wood of the central and western provinces.

TAIWANIA Hayata.

Taiwania cryptomerioides Hayata in Journ. Linn. Soc. xxxvii (1906), 330, t. 16; in Tokyo Bot. Mag. xxi (1907), 21, t. 1, fig. 23.

Taiwanites Hayata in Gard. Chron. ser. 3, xxxix (1906), 165.

Yunnan: in side valleys on the Yung-chang-Salwin divide, No. 17687, April 1918; in sheltered side valleys on the Salwin-Kiu Chang divide, No. 20310, September 1921; same locality, north-west of Si-chi-to, No. 21673, June 1922.

This rare monotypic genus is a native of Formosa, and its occurrence in western China, and nowhere in between, constitutes a remarkable instance of discontinuous distribution, paralleled only by that of *Libocedrus macrolepis*. First recorded by Handel-Mazzetti from the Salwin-Irrawaddy watershed, in the extreme north-west of Yunnan, *Taiwania* was found, subsequently, by Forrest on the Yung-chang-Salwin divide, some 200 miles south of the former locality, and, some years later, it was rediscovered by him on the Salwin-Kiu Chang divide, in the area previously explored by the Austrian expedition. Its former range is now extended into Upper Burma by the recent discovery of a typical specimen of *Taiwania* in the Lace Herbarium, collected between Myitkyina and Hpimaw by Maung Kyaw in 1912.†

According to Forrest, *Taiwania* in Yunnan is a denizen of open, mixed forest at moderate altitudes, and grows to a height of 70 ft.,

* E. H. Wilson in Sargent, Pl. Wilson. ii (1914), 51.

† M. Y. Orr in Notes Roy. Bot. Gard. Edin. xvii (1933), 6.

having a trunk diameter of 5-6 ft., five feet from the base. None of Forrest's specimens bear cones, but all are typical of the peculiar habit of the species.

CRYPTOMERIA D. Don.

Cryptomeria japonica D. Don. in Trans. Linn. Soc. xviii (1841), 167.

Cupressus japonica Linnaeus f. Suppl. (1781), 421.

Taxodium japonicum Brongniart in Ann. Sci. Nat. xxx (1833), 183.

Cryptomeria Fortunei Otto et Dietrich in Allg. Gartenz. (1853), 234.

Cryptomeria Kawaii Hayata in Tokyo Bot. Mag. xxxi (1917), 117.

Yunnan: dividing range between Pu-piao and Yung-chang valleys, No. 5510, April 1910; on the Ghi shan, east of Tali lake, No. 13469, August 1914; on the Salwin-Pu-piao divide, No. 19361, April 1921.

Cryptomeria japonica, named "goddess of mercy fir" by the Chinese in Yunnan, is a comparatively rare tree in the province, but it is not uncommon in other parts of China, although doubts have been expressed as to whether it is actually indigenous. Wilson, referring to its distribution in Szechuan, stated that it occurred in such remote places in the far west of the province that he suspected it to be a native of this region, but, later, after more prolonged exploration, he changed his opinion, and came to the conclusion that *Cryptomeria* was purely a Japanese tree, probably introduced into China by Buddhist priests.* The late Professor Henry expressed the view that *Cryptomeria* could be regarded as truly "wild" only in the mountains of Chekiang and Fukien, whereas Forrest was equally positive that in Yunnan, at least in some situations, this tree was growing in a wild state.

The identity of the Chinese *Cryptomeria* has been questioned also, and by some it has been considered to be sufficiently dissimilar to the Japanese species to merit varietal or specific rank. Certain minor differences in the cones have been recognised, but in Forrest's Yunnan material these distinctions are not particularly obvious, and there seem to be no good grounds for this separation.

Forrest describes the trees seen by him as being from 40 ft. to 90 ft. in height, but of no great girth at the base. These trees were growing singly, in open situations at moderate altitudes, or in forests, as on the Ghi shan, at 8-9,000 ft.

CUPRESSUS Linn.

Cupressus Duclouxiana Hickel in Camus, Les Cyprès (1914), 91.

Cupressus sempervirens Franchet in Journ. de Bot. xiii (1899), 263, non Linnaeus.

* E. H. Wilson in Journ. Arnold Arb. vii (1926), 60.

Cupressus torulosa Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 54, non D. Don.

Yunnan: around temples, along the base of the eastern flank of Tali range, No. 7380, November 1910; in cultivation around temples, Tengyueh valley, No. 8166, June 1918; semi-cultivated in Kan-ngai valley, No. 9486, January 1913.

In north-western Yunnan, according to Forrest, *Cupressus Duclouxiana* never occurs in a truly wild state, and is to be found chiefly in the neighbourhood of temples and human habitations. It is a graceful tree with slender branchlets, and very large, almost spherical cones. On the Tali range it grows to a height of 100 ft. Most of Forrest's specimens, all of which bear ripe cones, were collected at comparatively low altitudes of 3-5,000 ft. Young plants, raised from seed gathered by Forrest, are now growing in the Royal Botanic Garden at Edinburgh.

THUJA Linn.

Thuja orientalis Linn. Spec. (1753), 1002.

Thuja acuta Moench, Meth. (1794), 692.

Cupressus Thuia Targioni-Tozzetti in Ann. Mus. Firenze, i, pt. 2 (1808), 52.

Platycladus stricta Spach, Hist. Vég. xi (1842), 335.

Biota orientalis Endl. Syn. Conif. (1847), 47.

Yunnan: eastern flank of the Tali range, No. 4607, May-July 1906; Sungkwei valley, No. 7379, November 1910; on the hills surrounding the Tengyueh valley, No. 8173, June 1912; Shweli-Salwin divide, No. 24760, July 1924.

Thuja orientalis, the Chinese A f bor-vitae, like *Cryptomeria*, is doubtfully native in western China, and Wilson states that in his travels through the Orient he never saw a spontaneous example, while Forrest speaks of it as forming groves around temples, and refers to its extensive cultivation by the Chinese. At the same time, Forrest remarks that in some situations along the base of the Tali shan, and also in side valleys on the Shweli-Salwin divide, *Thuja orientalis* appears to exist in a wild state. It is described by him as being usually a shrub or small tree, although in the Sungkwei valley tall trees of upwards of 80 ft. in height were observed. The maximum elevation at which this species was found by Forrest is given as 8,000 ft.

JUNIPERUS Linn.

Juniperus formosana Hayata in Journ. Coll. Sci. Tokyo, xxv (1908), 209, pl. 38.

Juniperus rigida Beiss. in Nouv. Giorn. Bot. Ital. n. s. iv (1897), 186, non Sieb. et Zucc.

Juniperus communis Franchet in Journ. de Bot. xiii (1899), 264, non Linnaeus.

Juniperus taxifolia Masters in Journ. Linn. Soc. xxvi (1902), 543.

Juniperus Mairei Lemée et Léveillé in Monde des Pl. (1914), 20.

Yunnan: eastern flank of the Lichiang range, No. 6742, July 1910; at the eastern foot of the Sungkwei pass, No. 13770, May 1917; on the western flank of the Sungkwei range, No. 23164, August 1922; east of Lichiang, No. 30902, without date.

S.W. Szechuan: on mountains north-east of Mu-li, No. 21363, June 1922.

Juniperus formosana, the "prickly cypress," is widely spread throughout the mountains of China, and is frequently planted in temple grounds. Forrest describes it as a shrub, or tree, of 10-50 ft. in height, growing in open forest, up to 11,000 ft. in Yunnan, but ascending to 13,000 ft. in the Mu-li district of south-western Szechuan, and there forming thickets on the rocky, alpine slopes of the high mountains. In eastern Szechuan and western Hupeh, on the other hand, this juniper is said to grow in the margins of moist woods at comparatively low elevations.* Forrest's specimens are characterised by their linear leaves, mostly 1.5 cms. long, jointed at the base and sharply pointed at the apex, with two conspicuous stomatal bands on the adaxial surface. The ripe fruits on the Lichiang material are reddish-brown, about 6 mm. long and broad, each containing three seeds.

Juniperus squamata Buchanan-Hamilton ex Lambert, Genus Pinus, ii (1824), 17.

Sabina squamata Antoine, Cupress. (1857), 66, in part.

Juniperus densa Gordon, Pinet. Suppl. (1862), 32.

Juniperus recurva var. *squamata* Parlatores in DC. Prodr. xvi, pt. 2 (1868), 482.

Juniperus morrisonicola Hayata in Gard. Chron. ser. 3, xliii (1908), 194.

Yunnan: eastern flank of the Tali range, No. 6809, June 1910; Mekong-Salwin divide, No. 14951, September 1917; without locality or date, 30017, 30847, 30919.

N.E. Upper Burma: western flank of the Chimi-li, N'Maikha-Salwin divide, No. 24661, June 1924.

This polymorphous species has a wide range—from Formosa to the Himalayas—and is abundant at high altitudes in north-western Yunnan. Forrest found it growing in alpine pastures, on dry hillsides in limestone areas, and on screes amongst stones and boulders, at altitudes of 10-14,000 ft. In such situations as these it was a semi-procumbent or prostrate shrub, in places only a few inches high. The ascending

* E. H. Wilson in Sargent, Pl. Wilson. ii (1914), 57.

stems bear awl-shaped leaves in crowded whorls, and the fruits, which are about 1 cm. long, are characteristically one-seeded.

Juniperus squamata* var. *Fargesii Rehder et Wilson in Sargent, Pl. Wilson. ii (1914), 59.

Juniperus Lemeeana Lévl. et Blin in Lévl. Fl. Kouy-tcheou (1915), III.

Juniperus Fargesii Komarov in Not. Syst. Herb. Hort. Petrop. v (1924), 30.

Yunnan: on flanks of the Mingkwong valley, No. 8268, June 1912; N'Maikha-Salwin divide, Nos. 18033, 18038, 18850, June–November 1919; Chien-Chuan-Mekong divide, No. 22008, August 1922; Shweli-Salwin divide, No. 25377, November 1924; Tali range, No. 28234, October 1929; without locality or date, Nos. 30018, 30396, 30560, 30972.

This well-marked variety is described as an arborescent form of the species, but some of Forrest's plants were merely shrubs, not more than 5 ft. high. These particular plants, however, were found growing on rocky slopes in alpine situations above 10,000 ft., which may account for their stunted habit. Other examples, which were growing in sheltered ravines at lower levels, were upwards of 30 ft. in height, and might claim to be regarded as arborescent forms.

Forrest's specimens have grey-brown bark, which readily becomes exfoliated, and rather dense foliage. The leaves are variable, 5–10 mm. long, sharply pointed, and with a conspicuously whitened upper surface. The ripe fruits are of a bluish-black colour, and are about 7 mm. long. Seed of this variety was collected by Forrest on the Tali range, in the course of his last expedition.

Juniperus squamata* f. *Wilsonii Rehder in Journ. Arnold Arb. i (1920), 191; iv (1923), 126.

Juniperus squamata Rehd. et Wils. in Sargent, Pl. Wilson. ii (1914), 57, in part, non Lambert.

Juniperus squamata var. *Fargesii* auct. in Notes. Roy. Bot. Gard. Edin. xiv (1924), 342, 368, non Rehd. et Wils.

Yunnan: Lichiang range, No. 10496, July 1913; same locality, No. 22473, October 1922; on the Bei-ma-shan, No. 20974, October 1921; without locality or date, Nos. 30710, 30809, 30918.

S.W. Szechuan: mountains east of Yung-ning, No. 20506, July 1921; mountains south-east of Mu-li, No. 22991, October 1922.

Based on material collected by Wilson in Szechuan, this juniper is said to be only an ecological form, but typical examples are sufficiently distinct as to be readily recognisable. Forrest's specimens, which are characterised by their recurved branchlets, congested foliage, and shorter leaves, were cut from shrubs, growing on rocky alpine slopes at altitudes of 13–14,000 ft. No. 20974 has ripe fruits, which are bluish-

black in colour and are larger than those of the species. Seed of this form was collected by Forrest during his last expedition.

Juniperus recurva Buchanan-Hamilton, ex D. Don, Prodr. Fl. Nepal (1825), 55.

Sabina recurva Antoine, Cupress. (1857), 67, tt. 88, 90, 91.

Juniperus squamata auct. in Notes Roy. Bot. Gard. Edin. xiv (1924), 135; xvii (1929), 27, non Buchanan-Hamilton.

Yunnan: on the Li-ti-ping, No. 13903, June 1917; Shweli-Salwin divide, No. 15693, June 1917; same locality, No. 18048, June 1919; Salwin-Kiu Chiang divide, No. 20016, July 1921; Mekong-Salwin divide, No. 20792, September 1921; Sungkwei range, No. 21553, July 1922; Shweli-Salwin divide, Nos. 24749, 25190, 25300, 25374, July–November 1924; hills north-west of Tengyueh, No. 25382, November 1924; Mekong-Yangtze divide, north of Pien-tien go, Nos. 25488, 25893, June–October 1924; Shweli-Salwin divide, north of Ho-tou, No. 26276, March 1925; Shweli-Salwin divide, No. 29591, April 1931; without locality or date, Nos. 28230, 28231.

N.E. Upper Burma: western flank of the Chimi-li, N'Maikha-Salwin divide, Nos. 24973, 25963, September–November 1924; same locality, Nos. 26512, 26525, 27521, 27539, April–October 1925.

Juniperus recurva is distributed over a wide area in north-western Yunnan, although it is, primarily, a native of the Himalayas. It is known to occur also in Upper Burma, having been found on the N'Maikha-Salwin divide by both Farrer and Forrest. In Yunnan this species varies considerably in its habit according to the situation. When it is growing in alpine meadows and open pastures, or on rocky slopes and hillsides, at high altitudes, this juniper is a low, spreading shrub of 3–12 ft. high, with semi-pendulous branchlets; but when it is associated with other species in mixed or coniferous woods, or is growing in thickets in sheltered gullies, it becomes a graceful tree of 30–60 ft. in height. Across the frontier, in Upper Burma, trees of *Juniperus recurva* reach gigantic proportions, as is shown by Forrest's description of those he saw growing on the western flank of the Chimi-li, at altitudes above 10,000 ft. Referring in particular to No. 24973, Forrest writes, "Tree of 100–130 ft. Branches semi-pendulous. Trunk, not buttressed, 6–7 ft. in diameter, five feet from base. Bark ruddy-brown, that, and the wood, fragrant. Timber exported for coffin-wood to Yunnan. Known to the Chinese as *Shiang Chang Shu*." It was in the Chimi-li valley, and not far distant from the locality in which this particular tree was found—Forrest gives the latitude and longitude as 26° 23' N. and 98° 48' E.—that Farrer, in 1919, discovered such magnificent examples of the Coffin Juniper, of which a portion of the wood (No. 1407) is preserved in the Museum in the Royal Botanic Garden, Edinburgh. This sample of the wood, which is still fragrant, is the only relic of his find, for no specimens of the foliage were obtained; but it

seems reasonable to assume, from the data given by Forrest, and by Cox * (who accompanied Farrer on his last expedition), that the trees represented by Forrest's No. 24973 and by Farrer's No. 1407 are identical, and that both belong to the same species of juniper. This species, according to A. B. Jackson,† is not *Juniperus recurva*, but is *Juniperus Coxii*, a new species, which is founded on the characters of cultivated plants, grown from seed collected by Farrer and Cox in the Chimi-li valley in 1919.‡

The principal features which are said to distinguish *Juniperus Coxii* from *Juniperus recurva* are the more pendulous habit of the former, its longer, more tapering leaves, marked, on the upper surface, by two greenish-white bands of stomata, and the absence of multiple stems. Forrest's specimens from both sides of the Burma-Yunnan border have leaves which are slightly longer, and a shade more pointed, than those on his specimens from the Mekong-Yangtze watershed, a feature which may be correlated with local conditions; but, on the other hand, the longer, acicular type of leaf is equally characteristic of material collected by Hooker in Sikkim. Indeed, Forrest's specimens from the N'Maikha-Salwin divide are almost exact replicas of Hooker's herbarium material, and again these are identical with material of *Juniperus recurva* collected by Kingdon Ward in the Tsang-po gorge, Tibet. In all the specimens referred to, the upper surface of the leaves is characterised by the presence of two, rather indistinct, bands of stomata, separated by a narrow strip of epidermal tissue, and flanked on each side by a similar marginal strip, which becomes translucent at the extreme edge of the leaf. This arrangement is a distinctive feature also of the leaves of *Juniperus Coxii*, but whether it is a character of definite specific value in this particular case is a moot point.

By the courtesy of Mr. Jackson, the writer has had an opportunity of examining specimens taken from the tree of *Juniperus Coxii* at Exbury, and, it must be admitted, these exhibit certain minor points of difference when compared with cultivated plants of typical *Juniperus recurva* grown from Himalayan seed. In *Juniperus Coxii*, for example, the foliage tends to become more patent than is usual in *Juniperus recurva*, and it has a distinct olive-green tint. Furthermore, in the former both sides of the leaf are uniform in colour, and the whitened upper surface, so characteristic of *Juniperus recurva* in cultivation, has no counterpart in *Juniperus Coxii*. Their fruits are in no way dissimilar, however, and such relatively small differences in their vegetative parts as those enumerated above would appear to have no more than a varietal significance at most. On the other hand, having regard to the mutability of the foliage of native specimens from various sources, extremes of which are linked by intermediate forms, is it not more

* E. H. M. Cox, *Farrer's Last Journey* (1926), 66.

† A. B. Jackson in *The New Flora and Silva*, v (1932), 31.

‡ E. H. M. Cox, *The Plant Introductions of Reginald Farrer* (1930), 66.

probable that *Juniperus Coxii* is, after all, merely a geographical form of a widespread species, as Jackson himself suggests in the course of his discussion on the status of the Exbury tree? This view is held by the writer, and, therefore, he has referred Forrest's Burmese material (*Juniperus Coxii* sensu Jackson) to *Juniperus recurva*.

All Forrest's specimens, from whatever source, have brown-coloured stems with exfoliating bark, the ultimate branchlets being recurved and more or less concealed by the closely overlapping leaves. These, in the material from the Burma-Yunnan border, measure up to 7 mm. in length, and are sharply pointed. The one-seeded fruits, which are from 7 mm. to 1 cm. long, are of various shades of brown or purple according to the degree of ripeness.

Juniperus Wallichiana Hook f., ex Parlatore in DC. Prodr. xvi, pt. 2 (1868), 482.

Juniperus pseudosabina Hook f., Fl. Brit. Ind. v (1888), 646 non Fischer et Meyer.

Juniperus Wallichiana var. *meionocarpa* Hand.-Mzt. in Sitzgsanz. Akad. Wien (1924), 107.

Yunnan: on Bei-ma shan, No. 14029, June 1917; Mekong-Salwin divide, No. 14143, July 1917; on Ka-gwr-pu, Mekong-Salwin divide, No. 16706, July 1918; on Bei-ma shan, No. 19836, July 1921; Mekong-Salwin divide, No. 20087, September 1921; mountains north-east of Atuntze, Nos. 20361, 20736, September 1921; on Na-shu-to shan, Mekong-Yangtze divide, No. 20618, October 1921; Chien-Chuan-Mekong divide, No. 22323, September 1922; same locality, Nos. 23581, 23616, July-August 1923; without locality or date, Nos. 30554, 30855.

The occurrence of *Juniperus Wallichiana* in north-western Yunnan is another link with the Himalayan Flora—it is a native of the mountainous region extending from the Indus to Bhutan—and there seems to be no apparent difference between the Indian and Chinese representatives of the species. Forrest's specimens are characterised by their cinnamon-coloured stems, tetragonal branchlets, and closely packed adult foliage. None shows the juvenile state, but most of them bear fruits in various stages of development, and one in particular is a mass of beautiful blue berries. The ripe fruits are about 9 mm. long, ovoid in shape, and are produced on the tips of short branchlets, which are either straight or recurved. Each fruit contains a single rather large seed.

In their general appearance Forrest's specimens all bear a very strong resemblance to *Juniperus saltuaria* Rehder et Wilson, except that the fruits of the latter are smaller in size. It has been suggested that *Juniperus Wallichiana* and *Juniperus saltuaria*, which is a native of north-western Szechuan, may be geographical forms of one species.

At high altitudes in western Yunnan, according to Forrest, *Juniperus*

Wallichiana is a mere shrub, growing gregariously on open hillsides and beside streams, but in forests, at altitudes below 12,000 ft., it becomes a tree of upwards of 40 ft. in height. Seed of this species was collected by Forrest in the Wei Hsi area during his last expedition.

Juniperus chinensis Linnaeus, Mantissa, i (1767), 127.

Juniperus cernua Roxburgh, Fl. Ind. ed. 2, iii (1832), 839.

Juniperus dimorpha Roxburgh, Fl. Ind. ed. 2, iii (1832), 839.

Juniperus Thunbergii Hooker et Arnott, Bot. Voy. Beechey (1838 ?), 271.

Sabina chinensis Antoine, Cupress. Gattung. (1857), 54, t. 75.

Juniperus chinensis var. *pendula* Franchet in Nouv. Arch. Mus. Paris, sér. 2, vii (1884), 101.

Yunnan: sides of streams, Chungtien plateau, No. 362, 1904.

This juniper is one which is planted extensively by the Chinese, and is found growing frequently in the vicinity of temples and shrines, but it is said to occur also in a wild state in the mountainous districts of the western provinces. Forrest has recorded it only once from Yunnan—from the high plateau in the Yangtze bend—but it was found also by Rock, between Talifu and Lichiang, and cultivated examples have been observed in other parts of the province.

Forrest gives no particulars regarding his specimen of the Chinese Juniper, beyond stating that it came from a tree of 20-30 ft. high, which was growing at an altitude of 13,000 ft., but there is a special interest attached to it, for it was the first conifer material to be collected by him in western China.

EXPLANATION OF PLATES CCXL-CCXLII.

Illustrating Mr. M. Y. Orr's paper on the Coniferae collected by George Forrest.

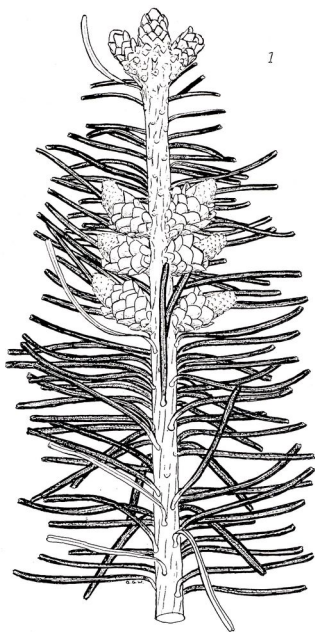
PLATE CCXL—Fig. 1. *Abies Faberi* Craib. Terminal portion of a shoot of No. 26559, from the N'Maikha-Salwin divide, Upper Burma. Fig. 2. *Abies Delavayi* Franchet. Terminal portion of a shoot of No. 20813, from the Tali range, north-western Yunnan.

PLATE CCXLI—Fig. 1. *Larix Potaninii* Batalin. Coning branch of No. 20210, from Hom-pu shan, north-western Yunnan. Fig. 2. *Larix Griffithii* J. D. Hooker. Coning branch of No. 27543, from the Chimi-li, N'Maikha-Salwin divide, Upper Burma. Fig. 3. *Keteleeria Davidiana* Beissner. Cone of No. 21428, from the Lichiang range, north-western Yunnan.

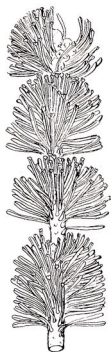
PLATE CCXLII—Fig. 1. *Picea brachytyla* Pritzel. Cone of No. 19472, from the Li-ti-ping, Mekong-Yangtze divide, north-western Yunnan. Fig. 2. *Picea likiangensis* Pritzel. Cone of No. 21401, from Mu-li, south-western Szechuan. Fig. 3. *Pseudotsuga Forrestii* Craib. Cone of No. 30851, north-western Yunnan.

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